Claims

1) A cavity ring-down spectrometer comprising:

i) a resonant optical cavity comprising at least two high reflectivity mirrors;

ii) a source for providing a continuous wave optical signal into said optical cavity, said source comprising an electrically pumped semiconductor gain medium;

iii) a first detector for monitoring the intensity of radiation emitted from said cavity and generating a first detection signal based thereon;

iv) a first controller for deactivating said optical signal based on a comparison of said first detection signal and a predetermined threshold and for thereafter reactivating said optical signal after a delay period in excess of the ring-down time for said optical cavity;

v) a second detector for monitoring the wavelength of the reactivated optical signal and generating a second detection signal based thereon;

vi) a second controller coupled to said second detector which second controller adjusts both the temperature of, and the current to, said gain medium to thereby achieve a desired emission wavelength;

vii) means for adjusting the beam path length of the optical cavity to be in resonance with said desired emission wavelength.

2) A cavity ring-down spectrometer in accordance with Claim 1 wherein said optical signal source comprises at least one distributed feedback diode laser.

3) A cavity ring-down spectrometer in accordance with Claim 1 wherein said optical signal source comprises an array of lasers.

4) A cavity ring-down spectrometer in accordance with Claim 1 wherein said first detector comprises a photodiode or avalanche photodiode.

5) A cavity ring-down spectrometer in accordance with Claim 1 wherein said first controller includes means for deactivating said optical signal by terminating the current flow to said semiconductor gain medium.

6) A cavity ring-down spectrometer in accordance with Claim 5 wherein said current flow is terminated by shunting the current to an alternative medium.

7) A cavity ring-down spectrometer in accordance with Claim 1 wherein said first controller includes means for shifting the frequency of said optical signal to a value out of the resonance range of the optical cavity.

8) A cavity ring-down spectrometer in accordance with Claim 1 wherein said second detector comprises an etalon, a beam splitter and a pair of photodiodes.

9) A cavity ring-down spectrometer in accordance with Claim 6 wherein said resonant optical cavity comprises three or four mirrors.

10) A cavity ring-down spectrometer wherein said second controller includes means for substantially continuously monitoring the temperature of the gain medium, and look-up tables indicating the temperature and current required to cause a desired laser emission wavelength.

11) A cavity ring-down spectrometer wherein said means for adjusting the beam path length of the optical cavity comprises a piezo-electric transducer capable of translating one of the cavity mirrors.

12) A method for detecting the presence of an analyte in a resonant optical cavity comprising at least two high reflectivity mirrors, said method comprising the steps of:

i) directing a continuous wave optical signal from an electrically pumped semiconductor gain medium into said optical cavity;

ii) detecting radiation emitted from said optical cavity through one of said mirrors and comparing the intensity of said emitted radiation with a predetermined threshold value;

iii) based on said comparison, generating a control signal which deactivates said optical signal for a period which is at least in excess of the ring-down time for said optical cavity;

iv) reactivating said optical signal and again directing said signal into said optical cavity

v) monitoring the wavelength of said signal;

vi) adjusting the temperature of, and current to, the source of said optical signal to thereby cause it to emit a signal having a desired wavelength;

vii) adjusting the beam path length of said optical cavity by translating at least one of said mirrors to thereby bring said cavity into resonance with said desired wavelength optical signal.

13) A method in accordance with Claim 12 wherein said optical signal is deactivated for a period of at least about five ring-down times.

14) A method in accordance with Claim 12 wherein said optical signal is deactivated by interrupting the current flow to said gain medium.